B-14

INSTRUCTION BOOK

MODEL 91CA

RF VOLTMETER

"Do not use" on Ser. Nos. below 4409

BOONTON ELECTRONICS CORPORATION

SERIAL NO. 5088

B-14

INSTRUCTION BOOK

MODEL 91CA

RF VOLTMETER

"Do not use" on Ser. Nos. below 4409

BOONTON ELECTRONICS CORPORATION

ROUTE 287 AT SMITH ROAD
PARSIPPANY, N. J.— 07054

TABLE OF CONTENTS

Section		Page
I	Specifications	1
II	General Description	2
III	Operating Procedure	3
	3.3 Initial turn-on procedure	3
	3.6 Measurement procedure	4
	3.7 Operating Precautions	5
IV	Theory of Operation	7
V	Maintenance	8
	5.1 Periodic Checking	8
	5.2 Calibration Precautions	8
	5.3 Calibration Check	9
	5.4 Trouble Shooting	9
	5.5 Calibration Adjustment	10
	Tables I, II, III	11 thru 13
	Warranty	14
	Parts List	15 thru 19
VI	Shipping Instructions	20
	Schematic	Backfold

SECTION I

MODEL 91 CA

SPECIFICATIONS

1.1	Measurement Range:		300 microvolts to 3 volts
1.2	Full Scale Ranges:		.001, .003, .01, .03, .1, .3, 1, 3 volts.
1.3	Frequency Range:		10 KC to 600 MC
1.4	Accuracy:	.003 range and above	5% of full scale to 200 MC 10% of full scale above 200 MC
		.001 range only	10% of full scale to 200 MC 15% of full scale above 200 MC
1.5	Input Impedance:		91-3B RF Probe See curve for shunt resistance data on high impedance probe. Shunt capacitance varies inversely with input voltage from 1.5 to 3pf. 91-8B 50Ω BNC Adapter Max. VSWR 1.2 up to 600 MC. 91-13A Probe Tip For direct measurements up to 250 MC.
1.6	Tube Complement:		1 each: BEC 525001, 7199, 6AU6, OA2, and 6X4.
1.7	Power Requirements:		105-125 volts, 58-62 ∿ 30 watts.
1.8	Dimensions		7-1/9 W, x 9-1/2 D, x 11 H excluding handle
1.9	Weight		12 pounds

SECTION II

GENERAL DESCRIPTION

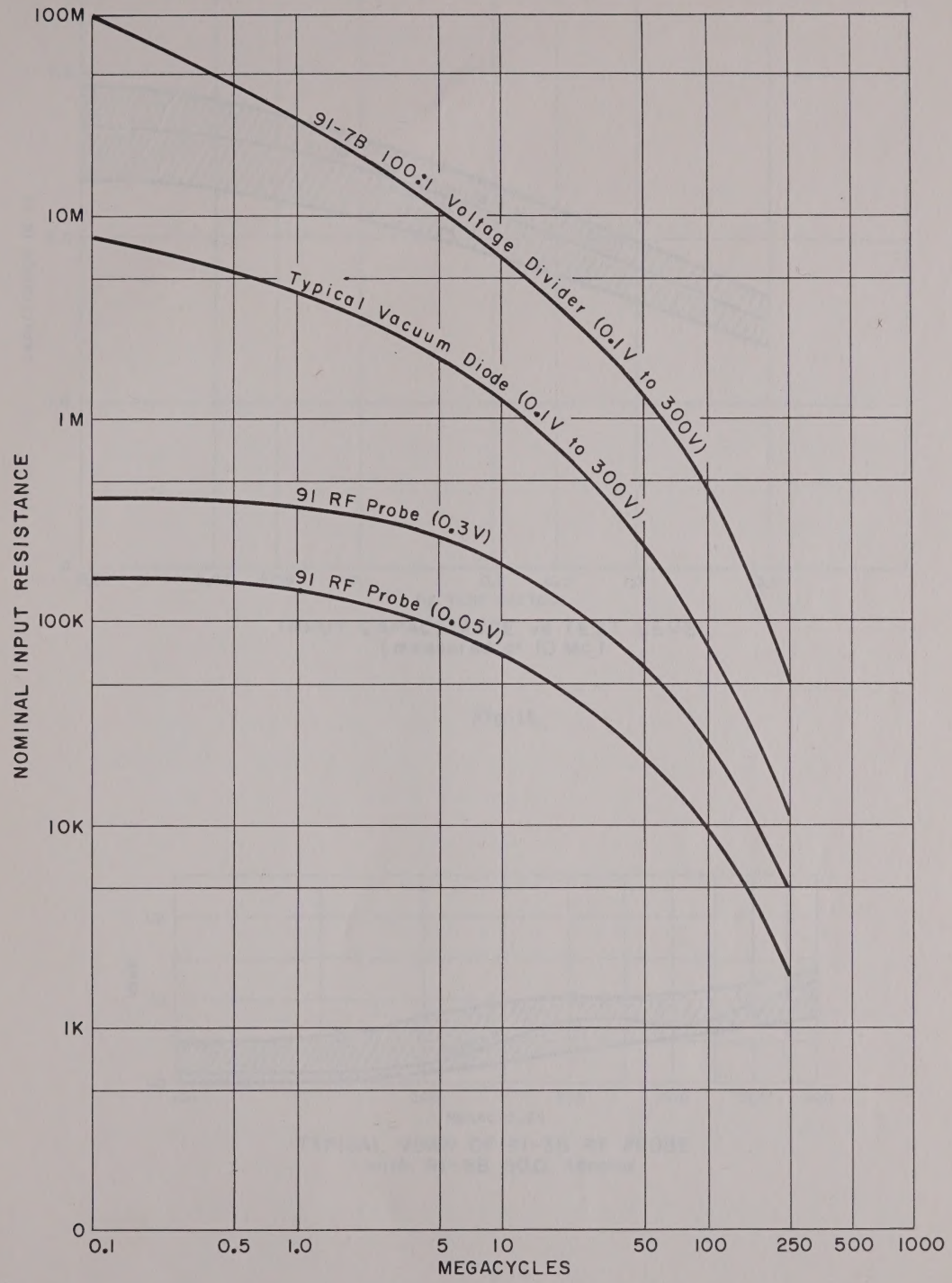
The 91CA RF Voltmeter is a sensitive instrument for the measurement of voltages of 300 microvolts to 3 volts spanning a wide frequency range of 10 kilocycles to 600 megacycles. In addition to conveniently measuring voltage levels in a diversity of rf circuits, the instrument has application for many associated tests. Such measurements include: the frequency response of both active and passive networks, i.e., amplifiers and filters; VSWR and return loss on transmission lines and attendant systems; attenuation and insertion loss of r-f attenuators; and high frequency parameters of transistors. With true rms response below 0.03 volt (up to 3 volts with the 91-7B, 100:1 divider), wide band noise can be measured, and using suitable null networks measurement of the harmonic distortion of RF waveforms can be performed without the attendant errors of average type meters.

The instrument is also useful as an r-f null detector for bridge measurements and analogous techniques when a sensitivity in the order of 200 microvolts will suffice.

Supplied with each instrument is a general purpose probe, 50 ohm adapter, and probe tip. The adapter is fitted with a BNC coaxial connector and provides a 50 ohm termination with a low VSWR up to at least 600 megacycles. The probe tip and companion ground clip are useful for direct measurement to approximately 100 megacycles. Above 100 megacycles, the probe may be used directly without the tip or ground clip, but the connecting leads must be extremely short to avoid resonant effects. In the special case where it is possible to connect the probe directly to the voltage source, the specified tolerance is maintained to at least 600 megacycles. The impracticability of such a connection, however, precludes our assuring the accuracy of the 91CA RF Voltmeter above 250 megacycles without the use of the 91-8B BNC 50 ohm adapter.

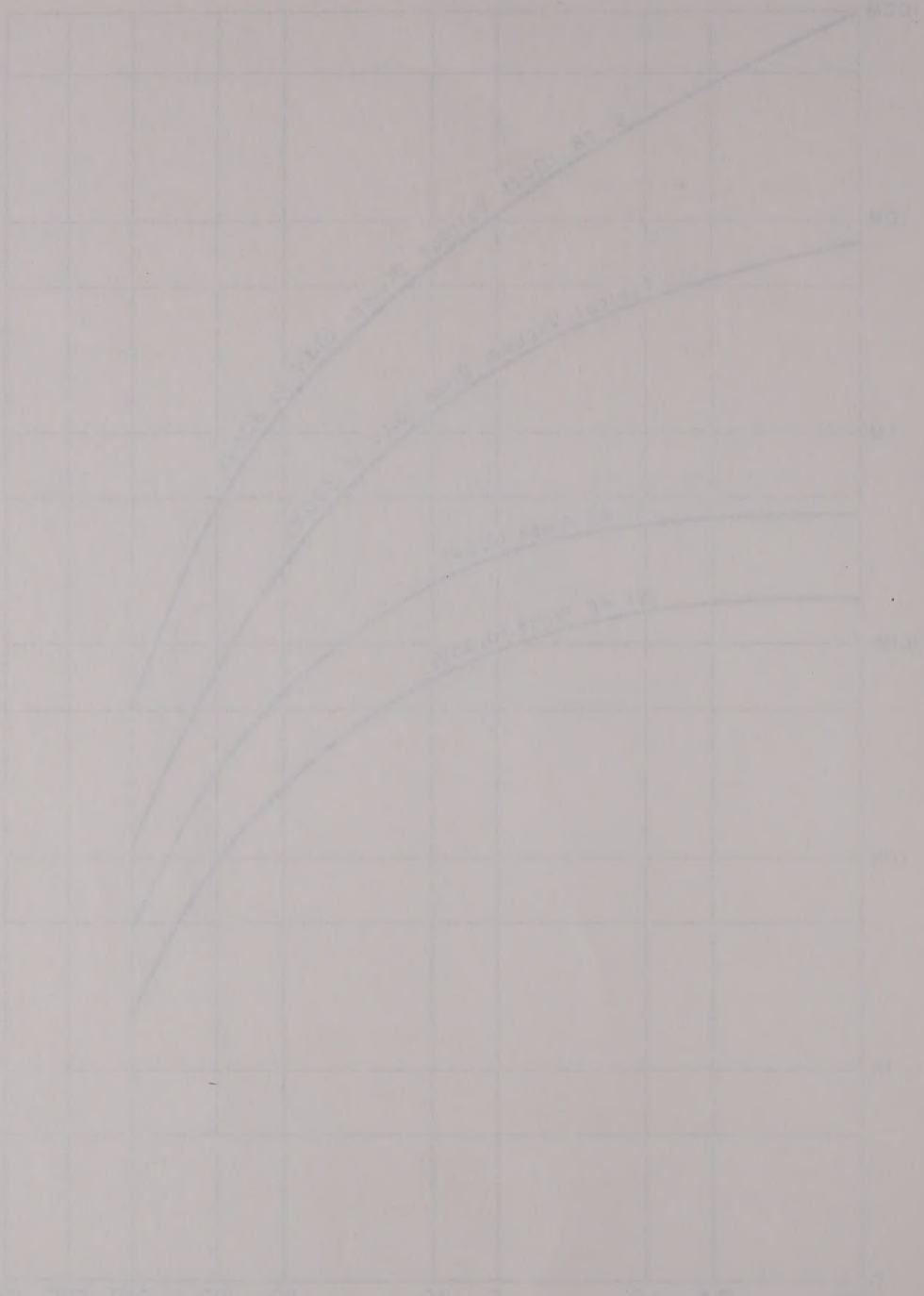
The 91-3B probe with its full-wave crystal detecting circuit produces a true rms response without turnover, or harmonic errors for all voltage levels below 0.03 volt, gradually changing to peak-to-peak reading (calibrated in rms) at approximately 1.0 volt. The probe has a shunt capacitance of approximately 2.5 pf at levels of 0.3 volt or higher, increasing slightly at levels of 0.1 volt or less. The shunt resistance component shown in Figure 1 is a variable factor, depending on the voltage and frequency.

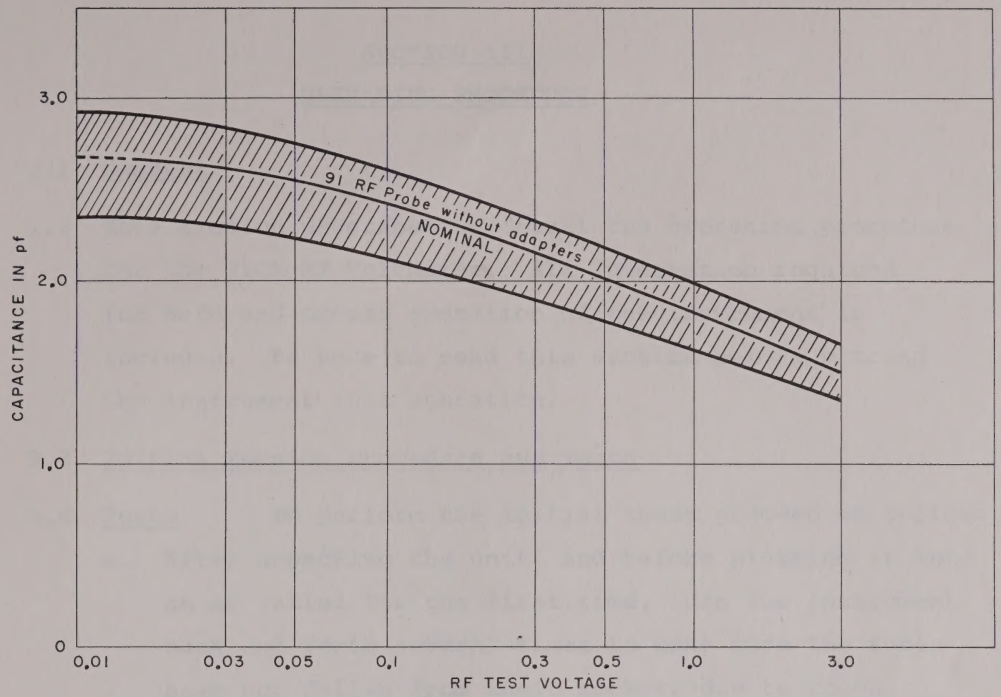
Figure 1 also shows the input resistance of the 91-7B, 100:1 voltage divider. When the frequency and the voltage to be measured permit, consideration should be given to the use of the 91-7B. In addition to extending the voltage range of the instrument to 300 volts, the benefit is threefold: the input resistance is increased above that available with vacuum tube diode probes, and the diode overload protection as well as the range of true rms response is increased by a factor of 100. The 100:1 divider may be used at frequencies up to 250 megacycles with negligible loading for most r-f circuitry.


100M
10M
1M
100K
10K
1K
0
NOMINAL INPUT RESISTANCE
91-7B 100:1 Voltage Divider (0.1V to 300V)
Typical Vacuum Diode (0.1V to 300V)
91 RF Probe (0.3V)
91 RF Probe (0.05V)
0.1
0.5
1.0
5
10
50
100
250
500
1000
MEGACYCLES

91D
a

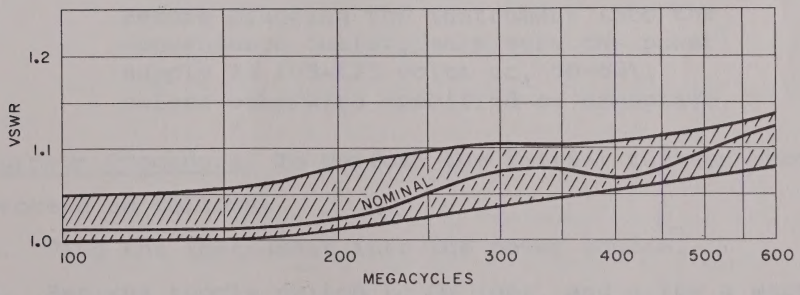
Fig 1a





INPUT CAPACITANCE vs TEST LEVEL
(measured at 10 Mc)

Fig 1b



TYPICAL VSWR OF 91-3B RF PROBE
with 91-8B 50Ω Adapter

Fig. 1c

SECTION III

OPERATING PROCEDURE

3.1 General

3.2 This section describes in detail the operating procedure for the 91CA RF Voltmeter. All information required for safe and proper operation of the instrument is included. Be sure to read this section before placing the instrument into operation.

3.3 Initial Turn-On Procedure and Tests

3.4 Tests To perform the initial tests proceed as follows:

a. After unpacking the unit, and before plugging it into an ac outlet for the first time, turn the instrument back and forth several times to make sure the tubes have not fallen from their sockets due to rough handling.

b. Observe the meter pointer to see that it moves freely and rests at zero when the instrument is steady.

c. If the pointer rests to the right or left of zero, set it at zero with the zero set screw.

CAUTION

Before plugging the instrument into the convenience outlet, make sure the power supply is 105-125 volts ac, 58-62∿, unless otherwise specified on nameplate.

3.5 Turn-On Procedure. To perform the initial turn-on procedure proceed as follows:

a. Plug the instrument into the power source.

b. Set the toggle switch to ON (up), and allow a warm-up period of approximately one minute.

c. Connect probe cable assembly to the instrument at jack marked PROBE. Check serial number of probe and see that it is the same as that of the voltmeter.

d. Set RANGE-FULL SCALE control to .001 and carefully adjust "BAL" control for minimum meter deflection. Normal meter deflection for zero input signal shall then be as follows:

RANGE	DEFLECTION
.001	less than 3/4 inch
.003, .01, .03, .1, .3, 1	less than 1/16 inch
3	Suppressed

3.6 Measurement Procedure

a. Set RANGE-FULL SCALE control to appropriate setting (or higher) for voltage to be measured.

b. Connect probe ground clip to ground point of voltage source under test. This connection must be as short and direct as possible to minimize errors arising from circulating RF currents in the ground return impedance.

c. Connect probe tip to high point of voltage source under test. This connection must also be as short as possible to minimize resonance rise effects at frequencies above 100 megacycles.

d. Read RF voltage on appropriate meter scale corresponding to setting of RANGE-FULL SCALE CONTROL.

e. To obtain relative level readings in decibels add the DB (red scale) meter reading to the DB (red) setting of the RANGE-FULL SCALE control. Although individual DB readings have no significance as measured on the 91 type RF Voltmeter the difference between two DB readings represents the actual change in level on a decibel basis. When used with a good signal generator the DB scale greatly facilitates the measurement of relative attenuation and bandpass characteristics of networks.

f. As it is frequently desired to measure RF voltages in coaxial systems the Model 91 is provided with a 50Ω coaxial adapter having a low VSWR up to 600 MC.

3.7 Operating Precautions

3.8 Maximum Input Voltages

RF voltages exceeding 10 volts must not be applied to the probe or permanent damage to the crystal diodes may result. The 50Ω adapter should not be subjected to continuous overloads exceeding 10 volts to avoid excessive heating of terminating resistor.

Maximum DC voltage for RF probe is 300 volts.

Maximum DC voltage for 50Ω adapter is 10 volts.

Note: Do not apply maximum DC voltage simultaneously with maximum RF voltage when using 50Ω adapter

3.9 Temperature Effects

The normal ambient temperature range for specified accuracy is 65° to 90° F. Appreciable inaccuracies can be expected while the probe is exposed to temperatures above or below this range. No permanent change in probe characteristics will result from the high or low temperature exposure.

Inaccuracies due to temperature effects may occur after soldering to the probe tip or from heat sources such as resistors or tubes.

When making low level measurements in the order of 2 millivolts or less, it is important to make sure that the probe has attained a uniform temperature throughout. A temperature difference between the inside and outside of the probe can generate a small thermal voltage that may add to or subtract from the DC voltage generated by the diodes.

3.10 Hum, Noise, and Spurious Pick-up

When measuring low level RF voltages, precautions should always be taken to avoid the possibility of erroneous readings resulting from hum, noise, or stray RF pick-up. Although all low frequency hum and noise is attenuated at the input by 60 db, it is still possible for high level unwanted signals to get through and cause errors. The best test for this condition is to reduce the test signal to zero level and note whether the voltmeter continues to read some spurious signal level. In some cases it may be necessary to provide extra shielding around the probe connections to reduce stray field pick-up. Typical sources of spurious radiation are induction or dielectric heating units, diathermy machines, local radio transmitters, grid dip meters, and amplifiers with parasitic oscillatons.

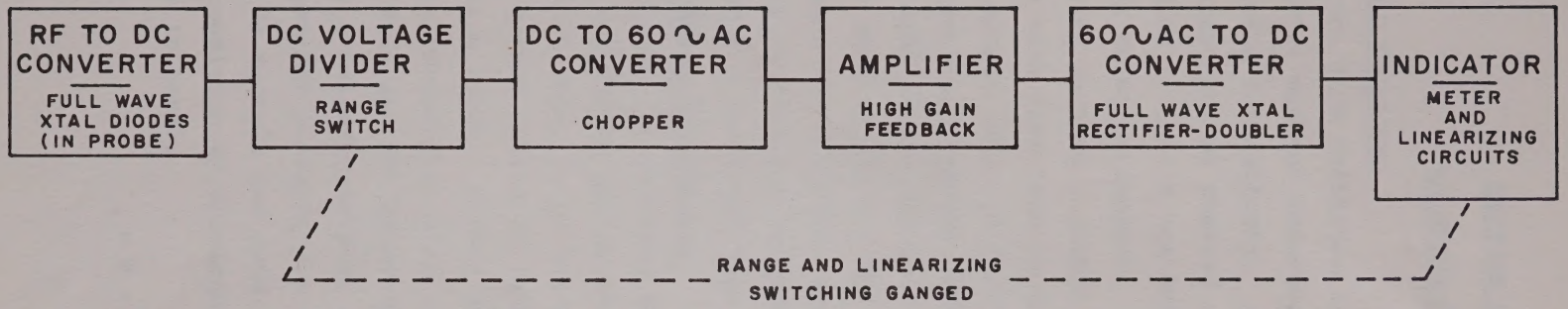
SECTION IV

THEORY OF OPERATION

An understanding of the operating features of the Model 91 Sensitive RF Voltmeter may be obtained by a study of the block diagram (Fig. 2) in conjunction with the following description.

The radio frequency voltage to be measured is rectified in the RF Probe by means of a full wave germanium diode rectifier circuit. The resulting DC potential is then attenuated as required before conversion to 60 ∿ AC by the chopper. This AC signal is then amplified in a narrow band feed-back stabilized amplifier prior to its re-conversion to DC for use in actuating the meter.

The germanium diodes used in the RF Probe have been carefully selected for several characteristics. As the selected diodes do not all exhibit the same rectification efficiency characteristics, it becomes necessary to adjust each meter range to match individual probe diodes. The range adjustments consist of individual non-linear circuits shunting the output meter circuitry. As the RANGE switch is set to the required test voltage position the appropriate non-linear adjusting circuit is automatically shunted across the output. It is also important to understand that the non-linear output circuitry is designed to compensate for the non-linear characteristics of the probe diodes when operating at levels below 0.3 volt.

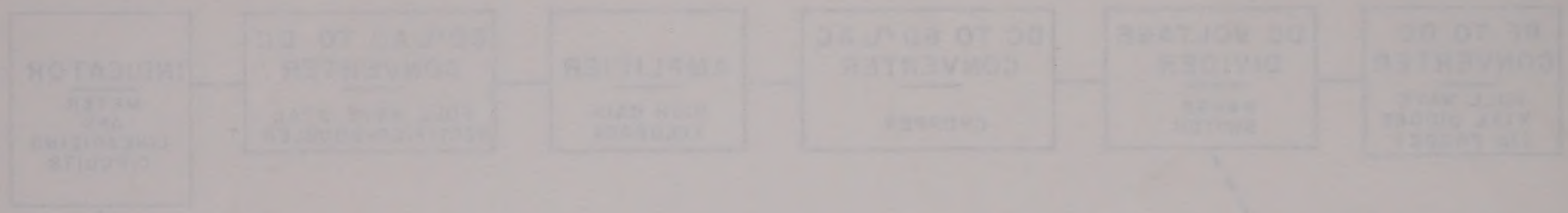


BLOCK DIAGRAM

TYPE 91, RF VOLTMETER

Figure 2

(A830,071A)



SECTION V

MAINTENANCE

5.1 Periodic Checking

The Model 91CA Voltmeter is designed to give long periods of service without maintenance when operated in accordance with these instructions. It is recommended, however, that the instrument be checked occasionally using reliable standards to insure against errors resulting from deterioration of tubes or chopper. To make these checks, it is necessary to have a signal source in the 200 to 500 KC region with less than 2% distortion at levels up to 3 volts across 50Ω. A precision electronic voltmeter of the averaging response type, such as the Ballantine Model 310A or 314, Hewlett Packard Model 400D or 400H, may be used to monitor the signal source for this purpose. To insure its accuracy, the monitoring meter should be checked at some low frequency (50-100 ∿) of good waveform against a dynamometer type AC meter of at least 1% accuracy.

5.2 Calibration Precautions

When attempting to check the voltage calibration accuracy on an instrument having the sensitivity and bandwidth of the Model 91CA, it is essential to take precautions to avoid errors resulting from stray pick-up voltages. (See paragraph 3.10). A well shielded signal source must be used in conjunction with coaxial connections to both the Model 91CA and the standard reference meter. Even with a well shielded generator and associated connections, it is sometimes possible for the reference meter to pick up stray RF signals and feed them into the probe. Check for this condition by disconnecting standard meter and noting change in level.

5.3 Calibration Check Procedure

With suitable calibrating equipment (paragraph 5.1) and taking necessary precautions (paragraph 5.2), we can now check the Model 91CA for calibration accuracy. Each range should be checked at a voltage representing 90% of full scale value. If these check points agree within ± 2% of the standard, it is recommended that no adjustment be made. If the check points deviate by more than ± 5% from the standard, it is recommended that a trouble shooting procedure be followed as outlined in paragraph 5.4. If the check points fall between 2% and 5% of the standard, the calibration adjustment procedure as outlined in paragraph 5.5 should be followed.

5.4 Trouble Shooting Procedure

a. Case Removal

The instrument may be removed from its case after first removing the two screws located at the back of the case (near the bottom) and the four screws located on the sides of the case near the front.

The power supply may be removed from the case after first removing the four screws located on the sides of the case near the rear.

b. Tube Replacement

If the tube V1 should become weak or noisy, it should be replaced with BEC 525001 or a commercial low noise 12AX7 which has low microphonism and meets the requirements of paragraph 3.5d above. The Telefunken ECC83/12AX7 has been found to meet these requirements consistantly. After replacing defective tubes, re-check calibration as outlined in paragraph 5.3 and adjust if necessary as described in paragraph 5.5.

c. Chopper Replacement

If a satisfactory operation is not obtained by replacing

tubes, a replacement chopper should be tried. If the new chopper does not clear the difficulty, place the original chopper back in socket.The calibration accuracy must be re-checked and adjusted, if necessary.

d. Voltage and Resistance Tests

After determining that the trouble cannot be cured by replacement of tubes or chopper, as described previously,it is advisable to make a systematic check of AC voltage, DC voltage, and resistance at each socket pin. Table I shows the nominal AC and DC voltages to ground from each socket pin number. Table II shows the nominal resistance values expected for each point. Large or erratic deviations from the listed values of voltage or resistance will serve as a valuable clue in tracking down a faulty component. Once the trouble has been found and corrected, the calibration must be re-checked and re-adjusted as outlined in paragraph 5.3 and paragraph 5.5.

5.5 Calibration Adjustment Procedure

Before making any calibration adjustments, it is essential to provide the necessary reference standards as described in paragraph 5.1 and take all precautions as outlined in paragraph 5.2. The calibration adjustment procedure shall than be made as outlined in Table III.

TABLE I

VOLTAGE MEASUREMENTS

Conditions:

117V 60∿ line input.

VTVM used for all measurements.

All measurements to chassis unless otherwise noted.

Input .01V at any frequency between 100 KC and 1 MC.

Use Ballantine Model 314 VTVM for all AC voltage measurements.

Pin #		1	2	3	4	5	6	7	8	9	10	11
Tube	DC	70	0	.76	53	53	90	0	.85	47	-	-
V1 BEC 525001	AC	2.7mv	1.4mv				.1V	2.3mv			-	-
	DC	.69	1.7	59	53	30	38	1.7	-	-	-	-
V2 (6AU6)	AC	.1				.78						
	DC	300	100	50	0	0	1.35	.1	170	96	-	-
V3 (7199)	AC	.4	21		6.3	6.3			18	21	-	-
	DC							350				
V4 (6X4)	AC	340		6.3	6.3		340					
	DC	150				150						
V5 (0A2)	AC											
	DC					52		150	300	0	47	58
11 Pin socket	AC	6.2	6.2	115	115							
	DC											
Chopper Socket	AC			1.5 mv								
Pin 10 to Pin 11 of 11 Pin Socket				DC 11 AC .32								
Pin 10 to Pin 5 of 11 Pin Socket				DC 5.4 AC .015V								

TABLE II

RESISTANCE MEASUREMENTS

Conditions:

Power turned off.

Tubes in sockets, chassis interconnected (11 Pin), all measurements to chassis.

Pin #	1	2	3	4	5	6	7	8	9	10	11
Tube											
V1 BEC 525001	1.2M	6.8M	11K	16K	16K	500K	2.2M	6.8K	16K	-	-
V2 (6AU6)	850K	3.8K	16K	16K	500K	1M	3.8K	-	-	-	-
V3 (7199)	68K	300K	1.1M			1.2K	1M	20K	1M	-	-
V4 (6X4)	300	-			-	300	68K	-	-	-	-
V5 (OA2)	50K	0	-	0	50K	-	0	-	-	-	-
11 Pin Conn.	-	-	∞	∞	17K	-	45K	60K	0	16K	16K

TABLE III

CALIBRATION ADJUSTMENT PROCEDURE

Step	Reference Std. Voltage	Voltage Range Setting Model 91CA	Adjust #	Adjust To Read	Notes
1.	.3	1	1	.3	Main gain adjustment: affects down scale readings on ranges 3 v to .1 v.
2.	.9	1	2	.9	Slope adjustment: affects up scale readings more than down scale: adjusts 1 v range only.
3.	2.5	3	3.	2.5	Slope adjustment: affects up scale readings more than down scale: adjusts 3 v range only.
4.	.25	.3	4.	.25	Slope adjustment: affects up scale readings more than down scale: adjusts .3 v range only.
5.	.09	.1	5	.09	Slope adjustment: affects up scale readings more than down scale: adjusts .1 v range only.
6.	.003	.01	6.	.003	Main gain adjustment: affects down scale readings on ranges .03 v to .003v.
7.	.005	.01	7	.005	Mid range slope adjustment: affects mid scale linearity on .01 v range only.
8.	.009	.01	8	.009	Slope adjustment: affects up scale readings more than down scale: .01 v range only.
9.	.025	.03	9	.025	Slope adjustment: affects up scale reading more than down scale: adjusts .03v range only.
10.	.0025	.003	10	.0025	Slope adjustment: affects up scale reading more than down scale: adjusts .003 range only.
11.	.0009	.001	11	.0009	Main gain adjustment: adjusts calibration of .001 v range only.

NOTE: Adjustment #1 to 6 are located from front to rear on right side of cabinet.
Adjustment #7 to 11 are located from rear to front on left side of cabinet.

WARRANTY

Boonton ELECTRONICS Corporation guarantees to the original purchaser that each instrument it manufactures is free from defects in material and workmanship for a period of one year after date of initial shipment. Our liability is limited to repairing or replacing any defective part with the exception of vacuum tubes, panel lamps, fuses, and batteries. The warranty lapses if, upon our examination, we judge that the instrument has been abused in any way.

PROCEDURE TO FOLLOW WHEN INSTRUMENT IS DEFECTIVE

1. Call our plant or our representative nearest you. A simple solution may result from discussion of the problem with our trained personnel.
2. If the fault is not readily eliminated, prepare the instrument for return to us. Pack carefully in a sturdy container using several inches of shock absorbing material on all six sides of the instrument. Include all probes, cables or accessory units. On all paper work pertaining to the returned instrument, note the model and serial number and state briefly the details of the fault. Ship to us transportation charges prepaid.
3. If the instrument is within the warranty, we will repair and return to you transportation charges prepaid. If the instrument is beyond the one year warranty period, we will repair and return it unless approval on a cost estimate is requested. If the instrument is within the one year warranty period, but our examination reveals abuse, we will await approval of our cost estimate before proceeding with repairs.

PARTS LIST 91CA

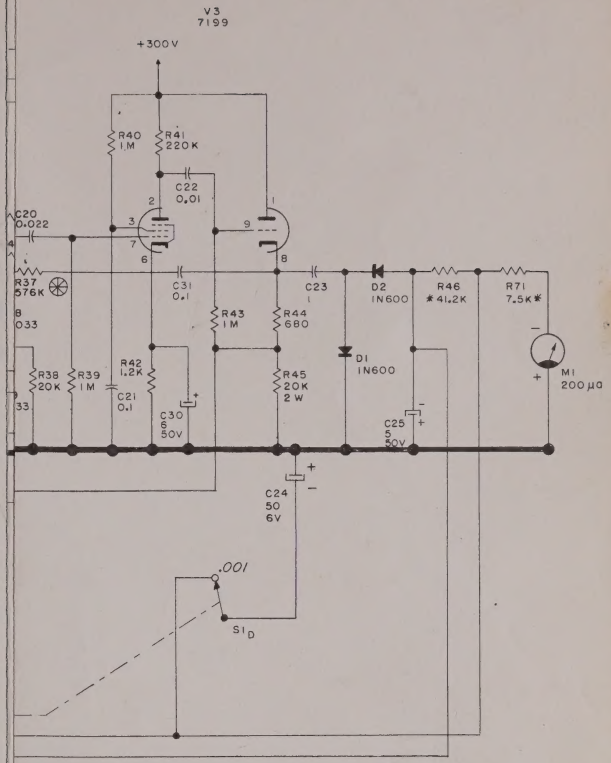
Reference		Description			BEC Part No.
C1	Capacitor, Mylar	0.1	µf	200V	230,116
C2	" Mylar	0.1	µf	200V	230,116
C3	" Mylar	0.1	µf	200V	230,116
C4	" Mylar	0.1	µf	200V	230,116
C5	" Mylar	0.0033	µf	200V	230,119
C6	" Mylar	0.022	µf	200V	230,101
C7a	" Elect.	20	µf	475V	283,139
C7b	" Elect.	50	µf	250V	
C8	" Mylar	0.005	µf	200V	230,121
C9	" Elect.	50	µf	6V	283,112
C10	" Elect.	50	µf	6V	283,112
C11	" Mylar	0.1	µf	200V	230,116
C12	" Mylar	0.022	µf	200V	230,101
C13	" Mylar	0.1	µf	200V	230,116
C14	" Mylar	0.1	µf	200V	230,116
C15	" Mylar	0.047	µf ±5%	200V	234,026
C16	" Mylar	0.002	µf ±5%	200V	234,024
C17	" Elect.	50	µf	6V	283,112
C18	" Mylar	0.033	µf ±5%	200V	234,025
C19	" Mylar	0.033	µf ±5%	200V	234,025
C20	" Mylar	0.022	µf	200V	230,101
C21	" Mylar	0.1	µf	200V	201,116
C22	" Mylar	0.01	µf	200V	230,120
C23	" Met. Paper	1.0	µf	200V	230,104
C24	" Elect.	50	µf	6V	283,112
C25	" Elect.	5	µf	50V	283,143
C27a,b,c	" Elect.	20-20-20	µf	475V	283,113
C28a,b	" Elect.	1000-1000	µf	15V	283,114
C29	" Disc.	0.05	µf	100V	224,117
C30	" Elect.	50	µf	6V	283,112
C31	" Mylar	0.1	µf	200V	230,116

Reference		Description	BEC Part No.
CH-1	Chopper,	BBM-Special	540,108
		Alternate Chopper	540,113
CR-1	Rectifier, Sel.	Sarkes-Tarzian #304B	432,001
D1	Diode	1N600	530,008
D2	Diode	1N600	530,008
D3	Diode	SG3113	530,009
D4	Diode	SG3113	530,009
F1	Fuse	MDL 0.5 Amp	545,504
I1	Lamp	#47	545,101
I2	Lamp	#47	545,101
J1	Recepticle	Amphenol 80-PC-2FT	479,119
J2	Socket	Amphenol 77-MIP-11	472,101
L1	Choke	Stancor #C1707 7HY	440,001
M1	Meter	Special 0-200 μa	554,139
P1	Plug (Input Cable)	Amphenol 80-MC-2M	479,101
P2	Plug (Amplifier)	Amphenol 86-PM11-11	477,105
P3	Plug & Adapter	P/O AC Line cord	568,101
R1	Resistor, Comp.	330K 1/2W 5%	301,147
R2	"	330K 1/2W 5%	301,147
R3	" Dep.Car.	5.11Meg. 1/2W 1%	306,788
R4	" " "	5.11Meg. 1/2W 1%	306,788
R5	" " "	464K 1/2W 1%	306,558

Reference	Description				BEC Part No.
R6	Resistor, Dep.Car.	464K	1/2W	1%	306,558
R7	" " "	47.5K	1/2W	1%	306,440
R8	" " "	47.5K	1/2W	1%	306,440
R9	" " "	6.81K	1/2W	1%	306,339
R10	" " "	6.81K	1/2W	1%	306,339
R11	" " "	1.39K	1/2W	1%	306,694
R12	" " "	1.39K	1/2W	1%	306,694
R13	" " "	675Ω	1/2W	1%	306,695
R14	" " "	675Ω	1/2W	1%	306,695
R15	" " "	2.2K	1/2W	5%	301,095
R16	" Comp.	6.8 Meg.	1/2W	5%	301,179
R17	" "	47K	1/2W	5%	301,127
R18	" "	1 Meg.	1/2W	5%	301,159
R19	" Dep. Car.	845Ω	1/2W	1%	306,231
R20	" " "	10K	1/2W	1%	306,359
R21	" " "	825K	1/2W	1%	306,589
R22	" Comp.	470K	1/2W	5%	301,151
R23	" "	6.8K	1/2W	5%	301,107
R24	" "	2.2 Meg.	1/2W	5%	301,167
R28	" "	470K	1/2W	5%	301,151
R29	" Variable	2K	2W	10% (11) ADJ	311,126
R30	" "	5K	2W	10% (1) ADJ	311,101
R31	" "	5K	2W	10% (6) ADJ	311,101
R33	" Comp.	1 Meg.	1/2W	5%	301,159
R34	" "	200K	1/2W	5%	301,142
R35	" "	200K	1/2W	5%	301,142
R36	" "	560K	1/2W	5%	301,153

Reference		Description				BEC Part No.
R37	Resistor, Dep. Car.	1Meg.	1/2W	1%		306,598
R38	" Comp.	20K	1/2W	5%		301,118
R39	" "	1M	1/2W	5%		301,159
R40	" "	1M	1/2W	5%		301,159
R41	" "	220K	1/2W	5%		301,143
R42	" "	1.2K	1/2W	5%		301,089
R43	" "	1Meg.	1/2W	5%		301,159
R44	" "	680Ω	1/2W	5%		301,083
R45	" "	20K	2W	5%		304,118
R46	" Dep. Car.	41.2K	1/2W	1%		306,432
R47	" Comp.	22Meg.	1/2W	5%		301,191
R48	" "	22Meg.	1/2W	5%		301,191
R49	" Variable	50K	2W	20%	Bal	311,125
R50	" Comp.	8.2K	1/2W	5%		301,109
R51	" "	8.2K	1/2W	5%		301,109
R52	" "	220K	1/2W	5%		301,143
R53	" "	24Ω	1/2W	5%		301,048
R54	" Variable	25K	2W	20%	(10) Adj	311,115
R55	" "	25K	2W	20%	(7) Adj	311,115
R56	" "	25K	2W	20%	(9) Adj	311,115
R57	" "	25K	2W	20%	(5) Adj	311,115
R58	" "	50K	2W	20%	(4) Adj	311,163
R59	" "	2Meg.	2W	20%	(2) Adj	311,178
R60	" "	250K	2W	20%	(3) Adj	311,103
R61	" Comp.	220Ω	1/2W	5%		301,071
R62	" "	1.5K	1/2W	5%		301,091
R63	" "	1.5K	1/2W	5%		301,091
R64	" "	1.5K	1/2W	5%		301,091
R65	" "	1.5K	1/2W	5%		301,091
R66	" "	18K	1/2W	5%		301,117
R67	" "	33K	1/2W	5%		301,123
R68	" Variable	10K	2W	20%	(8) Adj	311,102

Reference		Description	BEC Part No.
R69	Resistor, Comp.	5.6K 1/2W 5%	301,105
R70	" "	33K 1/2W 5%	301,123
R71	" Dep. Car	7.5K 1/2W 1%	306,344
R73	" Met. Film	3.9K 1/2W 5%	315,002
R76	" Comp.	1 Meg. 1W 20%	302,128
R77	" W.W.	7.5K 10W 10%	312,100
R78	" Comp.	5.6K 2W 5%	304,105
R79	" "	10 Ω 1/2W 5%	301,039
R80	" "	10 Ω 1/2W 5%	301,039
R81	" "	330K 1/2W 5%	301,147
S1	Switch 7 pole 8 pos.	spec. (91CA)	466,145
S2	" SPST. Carling #110-63		465,105
T1	Transformer	Power, special	446,016
V1	Elect. Tube	12AX7, special	525,001
V2	Elect. Tube	6AU6	526,6AU6
V3	Elect. Tube	7199	526,7199
V4	Elect. Tube	6X4	526,6X4
V5	Elect. Tube	0A2	526,0A2

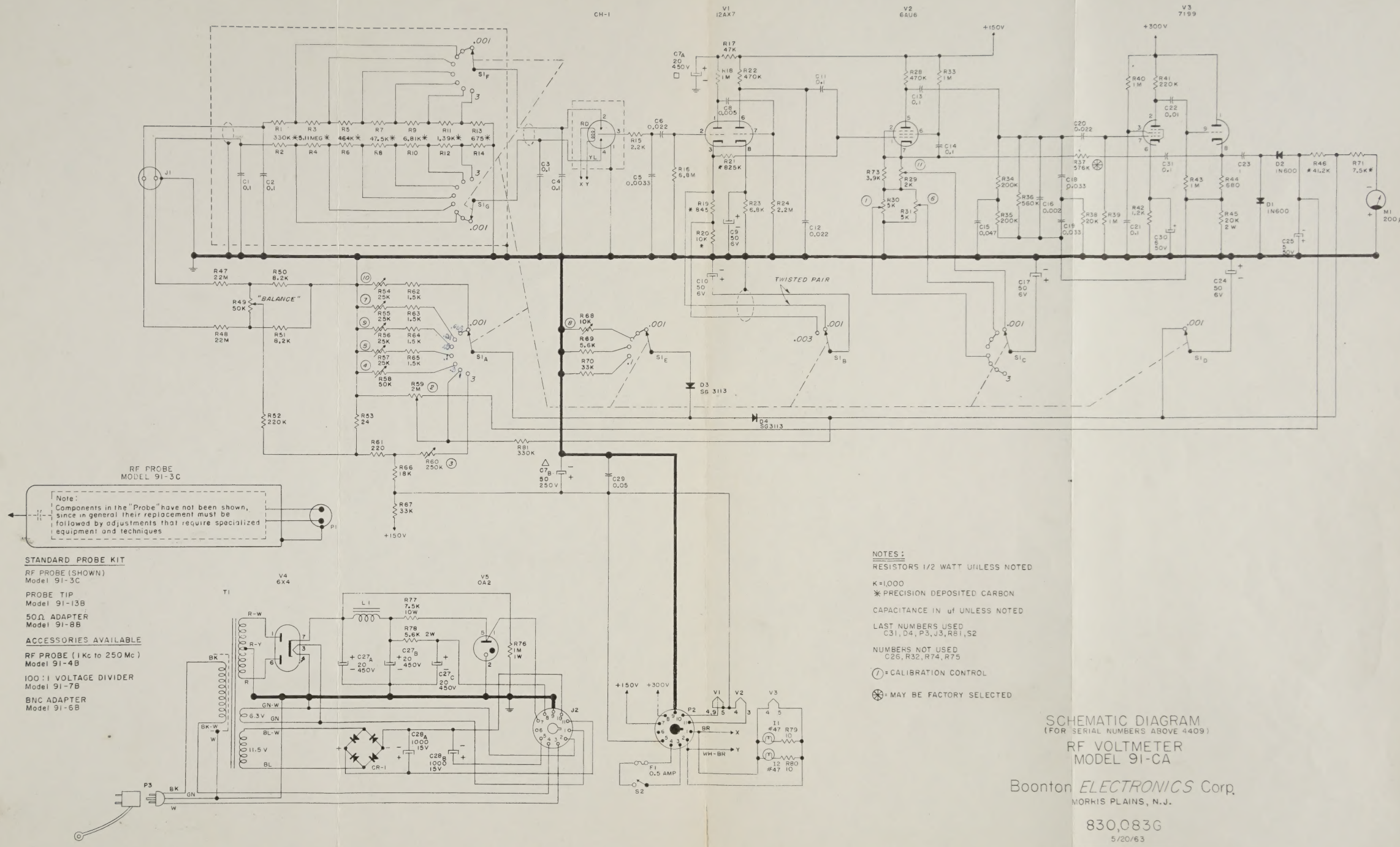


HEMATIC DIAGRAM
(SERIAL NUMBERS ABOVE 4409)
RF VOLTMETER
MODEL 91-CA

ELECTRONICS Corp.
MORRIS PLAINS, N.J.

830,083G
5/20/63

APP E.F.D. DATE 20 MAY 63



STANDARD PROBE KIT

RF PROBE (SHOWN)
Model 91-3C

PROBE TIP
Model 91-13B

50Ω ADAPTER
Model 91-8B

ACCESSORIES AVAILABLE

RF PROBE (1 Kc to 250 Mc)
Model 91-4B

100:1 VOLTAGE DIVIDER
Model 91-7B

BNC ADAPTER
Model 91-6B

NOTES:

RESISTORS 1/2 WATT UNLESS NOTED

K=1,000

✱ PRECISION DEPOSITED CARBON

CAPACITANCE IN uf UNLESS NOTED

LAST NUMBERS USED
C31, D4, P3, J3, R81, S2

NUMBERS NOT USED
C26, R32, R74, R75

(1) = CALIBRATION CONTROL

✱ = MAY BE FACTORY SELECTED

SCHEMATIC DIAGRAM
(FOR SERIAL NUMBERS ABOVE 4409)

RF VOLTMETER
MODEL 91-CA

Boonton *ELECTRONICS* Corp.
MORRIS PLAINS, N.J.

830,083G
5/20/63

APP EFD DATE 20MAY63

SECTION VI

SHIPPING INSTRUCTIONS

6.1 If it becomes necessary to ship the instrument for any reason the following steps should be followed.

a. Wrap the instrument with heavy wrapping paper and seal the seams with gummed tape. Place in fibre-board carton large enough to permit three inches of soft packing material between instrument and sides of box.

b. Separately wrap with heavy paper and pad the proper serial number probe and serialized resistance termination or other probe parts being shipped.